Generic Site-Wide
Sampling and Analysis Plan
Revision 02

Titanium Metals Corporation Facility
Henderson, Nevada

October 29, 2007

Prepared for:

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Henderson, Nevada

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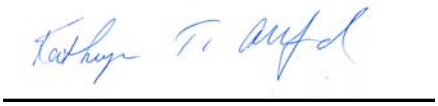

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JURAT: I, Kirk J. Stowers, hereby certify that I am responsible for the services in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulation and ordinances.

October 29, 2007

Kirk J. Stowers, C.E.M. (No. EM – 1549, Exp. 10/11/2008) **Date**
Broadbent & Associates, Inc.

TABLE 1: ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP
Generic Site–Wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

EPA QA/R-5 QAPP ELEMENT [a]		SAP	
A1	Title and Approval Sheet	Title and Approval Sheet	
A2	Table of Contents	Table of Contents	
A3	Distribution List	Distribution List (in transmittal letter)	
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Purpose and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Non-direct Measurements	2.9	Non-direct Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods		
D3	Reconciliation with User Requirements	4.2	Reconciliation with User Requirements

Notes:

a EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.

EPA U.S. Environmental Protection Agency
QAPP Quality assurance project plan
SAP Sampling and analysis plan

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

%R	Percent recovery
29 CFR	Title 29 Code of Federal Regulations
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BMI	Basic Management, Inc.
CLP	Contract Laboratory Program
CPR	Cardiopulmonary Resuscitation
CEM	State of Nevada Certified Environmental Manager
DQA	Data quality assessment
DQO	Data quality objective
ECA	Environmental conditions assessment
ECI	Environmental conditions investigation
ECIA	Environmental conditions investigation addendum
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
ft/ft	Foot per Foot
FPXRP	Field portable X-ray fluorescence
FTL	Field team leader
FID	Flame-ionization detector
GC/MS	Gas chromatography/mass spectrometry
GIS	Geographic information system
gpm	Gallons per minute
HASP	Health and safety plan
IDW	Investigation-derived waste
LCS	Laboratory control sample
LIMS	Laboratory information management system
LOU	Letter of understanding
MCAWW	Methods for Chemical Analysis of Water and Waste
MCF	Muddy Creek Formation
MCL	Maximum contaminant level
MD	Matrix duplicate
MDL	Method detection limit
msl	Mean sea level

MQO	Measurement quality objective
MS	Matrix spike
MSD	Matrix spike duplicate
NAC	Nevada Administrative Code
NDEP	State of Nevada Division of Environmental Protection
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, accuracy, representativeness, comparability, completeness, sensitivity
PPE	Personal protective equipment
PID	Photoionization detector
PQL	Practical quantitation limit
PRG	Preliminary remediation goal
PRRL	Project-required reporting limit
PVC	Polyvinyl chloride
QA	Quality assurance
Qal	Quaternary-age alluvial aquifer
QAPP	Quality assurance project plan
QC	Quality control
RPD	Relative percent difference
SAP	Sampling and analysis plan
SDG	Sample delivery group
SOP	Standard operating procedure
SOW	Statement of work
SQL	Sample quantitation limit
SRC	Site-related chemical
Tetra Tech	Tetra Tech EM Inc.
TCLP	Toxicity Characteristic Leaching Procedure
TIMET	Titanium Metals Corporation
VOC	Volatile organic compound

1.0 PROJECT DESCRIPTION AND MANAGEMENT

This generic site-wide sampling and analysis plan (SAP) was prepared for Titanium Metals Corporation (TIMET) of Henderson, Nevada in support of work conducted by the TIMET project team. This SAP consists of field sampling protocols and a quality assurance project plan (QAPP) in an integrated format.

The Nevada Division of Environmental Protection (NDEP) issued a request, dated April 20, 2006, for each of the companies in the Basic Management, Inc. (BMI) Complex to prepare and submit standard field sampling and quality assurance protocols in order to streamline the field sampling workplan approval process. The intent of this document is to standardize the field, laboratory, and data reporting efforts associated with future projects conducted at the TIMET facility.

This generic SAP was prepared in accordance with U.S. Environmental Protection Agency (EPA) QA/R-5 guidance document. Table 1, following the approval page, demonstrates how this SAP addresses the elements of a QAPP currently required by the EPA QA/R-5 guidance document (EPA 2001a). In order to maintain this structure, sections of the SAP which require specificity will not be included under this cover. TIMET proposes that future workplans will be developed utilizing this same structure written to address definitive data collection activities. As such, it is anticipated that subsections of Sections 1.0 and 2.0 will require revision and subsequent review and approval by the NDEP on a case-by-case basis. It is anticipated that Sections 3.0 and 4.0 meet the intent of this deliverable and will be referenced (when approved) in future workplan submissions.

Section 1.0 of the generic SAP includes an outline of project description and management elements that will be included in each project-specific SAP. Section 2.0 includes the generic sampling, testing, and data management methods applicable to site investigations. Section 3.0 includes generic assessment and oversight procedures and reporting, and Section 4.0 includes generic data validation and usability assessment procedures.

Tables and figures are sequentially numbered and follow their first mention in the text of this SAP, except for Table 1 which is located in the prologue. Appendix A contains method precision and accuracy goals, Appendix B lists project-required reporting limits (PRRL) and compares them to applicable soil and groundwater screening levels, Appendix C contains laboratory-specific information (provided in electronic format on compact disk), Appendix D contains a generic health and safety plan (HASP) (provided in electronic format on compact disk), and Appendix E contains field SOPs and appropriate field forms.

1.1 PURPOSE AND BACKGROUND

This section generally refers to the purpose of the investigation and the background of the facility. Because this document is meant to be a generic document, the subsections describing the purpose of the investigation, problem to be solved, and previous investigations are listed as

placeholder only. The project-specific SAP will address these topics, where applicable. This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Facility Background (Section 1.1.3)
- Site Description (Section 1.1.4)
- Physical Setting (Section 1.1.5)
- Summary of Previous Investigations (Section 1.1.6)

1.1.1 Purpose of the Investigation

The specific purpose of the investigation will be developed on a project-specific basis.

1.1.2 Problem to be Solved

The general problem to be solved at TIMET is to evaluate the presence, nature and extent, and environmental fate and transport of chemicals on the current SRC list that are above approved screening levels in environmental media both onsite and offsite. Data may be collected to meet diverse project objectives including site characterization and monitoring, exposure pathway evaluation, remedial alternative assessment, risk assessment, and source area closure.

The specific problem to be solved at the Plant Site and on adjacent properties to the TIMET facility will be developed on a project-specific basis. Section 1.3.1, Data Quality Objectives, will describe the problem statement and rationale for selecting the target analyte list for each investigation.

1.1.3 Facility Background

In 1991, the NDEP entered into Consent Agreements with the companies that had facilities at the BMI Complex in Henderson, Nevada; including TIMET. The following three phases were identified in the Consent Agreement:

- Phase I – Develop Phase I environmental conditions assessment (ECA) reports for the BMI Common Area which consists of the Upper and Lower Ponds, conveyance ditches and the Pabco Road Ponds Area and each individual company site

- Phase II – Perform an environmental conditions investigation (ECI) to fill data gaps identified in Phase I, if determined necessary by NDEP

- Phase III – Identify and implement appropriate remedial measures to address conditions identified in Phases I and II, if determined necessary by NDEP

TIMET completed a Phase I ECA, and results of the ECA were presented in the "Final Report of Phase I Environmental Conditions Assessment" (Law Engineering, Inc. 1993). Based on the information in the TIMET Phase I ECA and subsequent discussions with TIMET, NDEP issued a letter of understanding (LOU), dated August 16, 1994, that identified 54 study items where additional information or further investigation were recommended. On June 7, 1996, TIMET submitted complete responses to some of the LOU items, including identifying LOU items requiring additional investigation. In June 1996, NDEP entered into a Consent Agreement with TIMET to perform an ECI, remedial alternative studies, interim remedial measures, and additional work.

The action items identified in the LOU response were addressed in the Phase II ECI in accordance with the June 1996 Consent Agreement. Results of the ECI were reported in the "Final Environmental Conditions Investigation Report" (Tetra Tech 1998) and the "Environmental Conditions Investigation Addendum Draft Report" (Tetra Tech 1999). TIMET received a letter from NDEP dated December 1, 2003, that provided NDEP's responses to the ECI addendum (ECIA) report. Subsequently, NDEP's letter dated December 11, 2003, addressed the recommendation for accelerated work to abate, mitigate, and eliminate environmental contaminants. TIMET developed and is implementing a scope of work that responds to NDEP's recommendation for accelerated work in addition to continuing investigation of potential source areas, and implementing interim remedial actions toward source area closure.

1.1.4 Site Description

The TIMET facility, which is part of the BMI Complex, is located in unincorporated Clark County, Nevada, near the southeast margin of Las Vegas Valley. Figure 1 shows the location of the site. Figure 2 presents the physical features of the Plant Site.

The Plant Site comprises about 108 acres and includes management and operations buildings, process buildings and units, maintenance shops, landfills, material and equipment storage areas, retention ponds, tanks, roads and railroads. The Plant Site is used mainly for the manufacture of titanium industrial products, including titanium sponge and ingots. This process includes reacting titanium oxide with chlorine in the presence of coke to produce titanium tetrachloride and subsequently producing titanium by reducing titanium tetrachloride with magnesium. Magnesium and chlorine are recovered as molten magnesium metal and chlorine gas from magnesium chloride, which is generated during the vacuum reduction process by passing an electrical current into an electrolytic cell.

1.1.5 Physical Setting

The Plant Site is in the Las Vegas Valley, a broad alluvial valley that occupies a structural basin in the Basin and Range Physiographic Province. The Las Vegas Valley is surrounded mostly by mountains, ranging from 2,000 to 10,000 feet higher than the valley floor. The valley floor ranges in elevation from about 3,000 feet above mean sea level (msl), in the west at the mountain front, to 1,500 feet above msl, in the east at the Wash (Southern Nevada Water Authority 1996). The surrounding mountain ranges as shown on Figure 1 are:

- Sheep Range to the north
- Frenchman and Sunrise Mountains to the northeast
- River Mountains to the east
- McCullough Range to the south

Spring Mountains and Sierra Nevada Mountains of California to the west

The valley is about 1,550 square miles in size, and the structural and topographical axis is aligned approximately northwest to southeast. The eastern edge of the valley is about 5 miles west of Lake Mead, a major multipurpose reservoir on the Colorado River.

All surface water in Las Vegas Valley is tributary to Lake Mead via the Wash (Brothers and Katzer 1988), the major drainage in the valley. The Wash collects storm water, shallow groundwater, urban runoff, and treated sewage effluent. It is the receiving water body for all major Las Vegas area discharges. In dry weather, flow in the Wash comprises mainly treated effluent from the Clark County Water Reclamation District (76 million gallons per day) and the City of Las Vegas Water Pollution Control Facility (80 million gallons per day). The City of Henderson contributes a smaller amount (8.4 million gallons per day) (Las Vegas Wash Coordination Committee 2000). TIMET discharges permitted water via the Pittman By-Pass (NDEP 2005) to the Las Vegas Wash. Discharge from all sources is sufficient to maintain surface flows in the Wash throughout the year.

The Plant Site is located about two miles south of Las Vegas Wash, at an elevation that ranges from 1,873 feet above msl at Lake Mead Drive to about 1,750 feet above msl at the northern property boundary. From the Plant Site, the land surface in this area slopes north-northeast toward the Wash at a rate of about 0.02 foot per foot (ft/ft).

1.1.6 Summary of Previous Investigations

Previous investigations at the site have focused on characterization of groundwater and soil. These previous investigations are described below.

1.1.6.1 TIMET Environmental Conditions Investigation

In 1993, a Phase I ECA was conducted at the TIMET facility (Law Engineering 1993). Based on the findings of the Phase I ECA and subsequent discussions with TIMET, the NDEP issued a LOU dated August 16, 1994, that identified 54 study items on the TIMET facility where additional information or further investigation were recommended. TIMET submitted a response to the LOU dated June 7, 1996, that provided complete responses to most items and identified some items that required additional investigation. Items that required additional investigation were addressed in the ECI Workplan (Tetra Tech 1997). The primary objectives of the ECI were to (1) satisfy the requirements of the LOU, dated August 16, 1994, which included characterization of potentially affected media at or near sites identified as requiring additional investigation in the response to the LOU, and (2) collect data of adequate technical quality to support development and evaluation of potential remedial alternatives at the TIMET facility. A total of 120 soil, 10 groundwater, 4 sediment, 3 surface water, and 4 waste samples were collected during the ECI.

1.1.6.2 TIMET Environmental Conditions Investigation Addendum

The ECIA was prepared in response to comments on the draft ECI report. The ECIA focused on areas of the site requiring further action (Tetra Tech 1999). The primary objectives of the ECIA were to (1) address, in combination with the final ECI, the issues raised in the NDEP comment letter, dated June 10, 1998, and the supplemental review letter, dated July 9, 1998; (2) collect data of adequate technical quality to fill data gaps to help develop and evaluate potential remedial alternatives at the TIMET facility; and (3) provide remedial action plans for areas where the extent of contamination is defined and limited. A total of 17 soil (roadway) and sediment and 85 groundwater samples (102 samples total) were collected during the ECIA. To address NDEP comments (NDEP 2003), a revised ECIA report was issued on January 24, 2005 (Tetra Tech 2005).

1.1.6.3 TIMET Groundwater Monitoring Program

The groundwater monitoring program was conducted as part of the requirements for data collection presented in the ECI Workplan (Tetra Tech 1997), the ECIA (Tetra Tech 1999), and revised in the Groundwater Monitoring Program SAP (TIMET 2007d). The purpose of the groundwater investigation is to (1) characterize the distribution of inorganic, organic, and radionuclide analytes in groundwater; (2) characterize the hydraulic characteristics of the aquifer; and (3) evaluate relationships between groundwater chemistry, hydrogeology, and potential sources. The following activities are conducted as part of the groundwater monitoring program:

- Measure groundwater levels in wells
- Collect groundwater samples for field and chemical analysis
- Evaluate groundwater hydraulic and water quality data
- Analyze groundwater data for trends and by comparison with applicable water quality standards

The groundwater monitoring wells were generally analyzed for total metals, VOCs, alkalinity, anions (chloride, nitrate, and sulfate), pH, radionuclides, and total dissolved solids. Additional analytical methods (such as perchlorate and pesticides) were added to a specific sampling event. Details about the overall groundwater monitoring program and a data summary from the first quarter of 2000 through the fourth quarter of 2006 are presented in the fourth quarter 2006 groundwater monitoring report (Tetra Tech 2007c). Groundwater data for subsequent sampling events are documented in the quarterly groundwater monitoring reports.

1.1.6.4 Hydrogeologic Characterization

A field sampling effort was undertaken in the winter of 2005 and the spring of 2006 to address specific data needs identified in the preliminary CSM (Tetra Tech 2004). The following field activities were conducted as part of the hydrogeologic characterization:

- Installed eight soil borings and groundwater piezometers at the Plant Site boundary to obtain lithologic data as part of a paleochannel assessment
- Installed four groundwater monitoring wells on the Plant Site in the alluvial aquifer and the Intermediate Tertiary-Age MCF aquifer to assess upgradient conditions
- Advanced 13 soil borings in PSAs at the Plant Site for vertical delineation of potential effects from source areas
- Measured water levels in the alluvial aquifer at existing and new wells at the Plant Site and selected off-site existing wells to generate a regional potentiometric surface map
- Collected groundwater samples from monitoring wells installed at the Plant Site and selected existing off-site wells to assess groundwater effects downgradient from the Plant Site
- Conducted hydraulic tests at a select list of Plant Site and off-site wells to assess hydraulic conditions of the alluvial aquifer

The findings from this investigation were integrated into development of the Conceptual Site Model (TIMET 2007b).

1.1.6.5 BRC/TIMET Soil Background Study

A soil background study was conducted jointly by BRC and TIMET. Soil samples from 35 soil borings, at 11 property locations were collected at three depth intervals. Samples were analyzed for metals, anions, radionuclides, and soil geochemistry. Data were combined with the City of Henderson background soil data from 8 soil borings (known as the Environ dataset). Background samples were collected from soils up to a depth of 10 feet bgs, and were analyzed

for metals, anions, and radionuclides. No background soil data have been collected at soil depths greater than 10 feet bgs or in the Muddy Creek soils.

The results of the background soil study are documented in the Background Soil Summary Report, BMI Complex and Common Areas submitted to the NDEP on March 16, 2007 (TIMET 2007a). Descriptive summary statistics and a variety of statistical plots are included in the Background Soil Summary Report to facilitate evaluations of site data and site-to-background data comparisons.

1.2 PROJECT DESCRIPTION

{Not addressed in this document. To be developed in the project-specific SAP}

1.2.1 Project Objectives

{Not addressed in this document. To be developed in the project-specific SAP}

1.2.2 Project Measurements

{Not addressed in this document. To be developed in the project-specific SAP}

1.3 QUALITY OBJECTIVES AND CRITERIA

This section discusses DQOs and measurement quality objectives (MQO).

1.3.1 Data Quality Objectives

{Not addressed in this document. To be developed in the project-specific SAP}

1.3.2 Measurement Quality Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCCS parameters, precision and accuracy will be evaluated quantitatively by collecting the quality control (QC) samples listed in Table 2. Specific precision and accuracy goals for these QC samples are listed in Appendix A.

TABLE 2: QC SAMPLES FOR PRECISION AND ACCURACY
Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

QC Type	Precision Measurement	Accuracy Measurement	Frequency
Field QC	Field duplicate RPD	Trip Blank Equipment Rinsate Source water blank	Field duplicate = 1 per 10 water samples Trip Blank = 1 per cooler containing samples for analysis of volatile organic compounds Equipment Rinsate = 1 per type of equipment used for sampling that is decontaminated and reused (not required for one-time-use or dedicated equipment) Source water blank = 1/sampling event/source of water used for the final decontamination rinse
Laboratory QC	MS/MSD RPD MD RPD	MS/MSD %R Method Blanks LCS %R Surrogate %R Internal responses	MS/MSD = 1/20 samples [1] MD = 1/20 samples Method Blank = 1/20 samples or analytical batch LCS = 1/20 samples or analytical batch Surrogate = Every sample for organic analysis by GC/MS Internal Standards = Every sample for organic analysis by GC/MS

Notes:

%R	Percent recovery
GC/MS	Gas chromatography/mass spectrometer
LCS	Laboratory control sample
MD	Matrix duplicate
MS/MSD	Matrix spike/matrix spike duplicate
QC	Quality control
RPD	Relative percent difference

1 MS/MSD analyses are not required for total dissolved solids and radionuclides.

The subsections below describe each of the PARCCS parameters and how they will be assessed within this project.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

$$RPD = \frac{|A - B|}{(A + B)/2} \quad x \quad 100\%$$

where:

A	=	First duplicate concentration
B	=	Second duplicate concentration

Field sampling precision is evaluated by analyzing field duplicate samples. Laboratory analytical precision is evaluated by analyzing laboratory duplicates, also known as matrix duplicates (MD) or matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be generated for all analytes, except for total dissolved solids and radionuclides that will use MDs for measuring precision. Results of the analysis of each MS/MSD or MD pair will be used to calculate an RPD for evaluating precision.

1.3.2.2 Accuracy

Accuracy is the degree to which a measurement agrees with its true value and is expressed as percent recovery. A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCS), also known as blank spikes, surrogate spikes, method blanks, and calibration standards. The frequency for each of these accuracy measurement types is presented in Table 2. Results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$Percent\ \ Recovery = \frac{S - C}{T} \quad x \quad 100$$

where:

S	=	Measured spike sample concentration
C	=	Sample concentration
T	=	True or actual concentration of the spike

Appendix A presents accuracy goals for the investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated based on the results of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Field QC blanks and laboratory method blanks will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be non-representative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

Completeness will also be evaluated as part of the data quality assessment process (EPA 2000c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.2.6 Sensitivity

Sensitivity of the analytical method is described by the method detection limit (MDL). The MDL is defined as the minimum concentration of an analyte that can be reliably measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is

determined from analysis of a sample in a given matrix type containing the analyte (EPA 2004e) The sample quantitation limit (SQL) represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix and includes all sample-specific factors (such as moisture content and dilution factors). Appendix C-2 contains the current MDLs reported by TIMET's contractor laboratory, Paragon Analytics, Inc., of Fort Collins, Colorado.

PRRL, also known as practical quantitation limits (PQL), are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the MDL to allow for matrix effects. PRRLs, which are established in the scope of work for subcontract laboratories, are set to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

Analytical methods have been selected so that the PRRL for each target analyte is below applicable regulatory screening criteria, maximum contaminant levels (MCL) (EPA 2004d), and preliminary remediation goals (PRG) (EPA 2003 and 2004c), wherever practical. Appendix B compares the PRRLs for the selected analytical methods with MCLs, industrial PRGs, and soil-to-groundwater soil screening levels. The goal was to obtain PRRLs that were at least one-half the lowest applicable screening level. Paragon's MDLs were used a guides in determining reasonable PRRLs; however, they are not necessarily equal to Paragon's MDLs. Appropriate steps will be taken by the laboratory to achieve the PRRLs in Appendix B. Paragon's MDLs are included in Appendix C-2.

Several cases exist where the PRRLs are greater than the lowest screening level presented in Tables B1 and B2. In these cases, the screening level is highlighted in the tables using bold font. While exceedances of screening levels exist, it is recognized that the screening levels will be used for initial screening of results. Many of the PRRL exceptions are for analytes that are not specifically suspected of being present at the site but which are being included to assure a broad screening for potential chemicals of concern. In addition, most of the exceptions involve analytes associated with multiple component analyses, where the broad applicability of the selected method is more important than ensuring that each target analyte has a PRRL below the PRG. It is also recognized that actual sample quantitation limits may be lower than the PRRLs, as MDLs are updated in the laboratory. The reported PRRLs represent the concentrations reportable by the laboratory at the time of this document preparation.

Analytical results will be reported as estimated values if concentrations are less than PRRLs but greater than SQLs. The MDL, SQL, and PRRL for each analyte will be included in the laboratory's electronic data deliverable (EDD). This procedure is being adopted to help ensure that analytical results can effectively be compared with PRGs for certain compounds where the PRRL is near or below the PRG. This procedure also will help to ensure that future statistical evaluations of the data will not be biased by high-value nondetect results.

1.4 PROJECT ORGANIZATION

The responsibilities and contact information for key personnel involved will be determined for each project. The project organization will define the lines of communication and identifies key personnel assigned to various project activities. The respective work plan will provide a description of the organizational structure and specific responsibilities of the individual positions for the respective project activities. Since the TIMET project team is dynamic, the organization and key personnel are defined and updated to NDEP as a separate deliverable.

NDEP is the oversight agency for the TIMET facility data collection activities. NDEP will provide regulatory oversight for all aspects of investigative and remedial activities at the facility and offer direction on NDEP policy and environmental objectives. All field activities and reports will be supervised by a State of Nevada Certified Environmental Manager (CEM).

The collaborative team consultants have responsibility for assigned phases of investigation and reporting. Together, the management team (Program Director, Project Manager, Task Managers, Technical Leads, and Field Managers) will be responsible for the technical planning and implementation of the prescribed work. Other responsibilities include strategy development, budget control, project schedule, and document review. The quality assurance (QA) staff has responsibility for effective planning, verification, and management of QA activities associated with the assigned project. The project management team members are established by TIMET and approved by the NDEP. The project management team members are designated in the project organizational charts and resumes presented to NDEP and periodically updated as assignments change.

All fixed-laboratory analytical services will be provided by an NDEP-approved laboratory. The laboratory will perform analytical testing for samples collected during various field events. The respective laboratory's project manager will report to the Field Manager, on all aspects of the sample analysis. In addition, the QA Manager will be advised of any matters related to data quality during the course of the investigation. The laboratory will conform to the QA and QC procedures, outlined in the respective laboratory Quality Assurance Plans (maintained by the laboratory) and laboratory SOPs. Because of the uniqueness of radionuclide analyses, copies of laboratory SOPs for radionuclide analyses are included in Appendix C and maintained in the project files. If the status of the laboratory changes, then Appendix C will be updated accordingly.

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for all personnel working on the project site.

1.5.1 Health and Safety Training

All personnel who work at this project site are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 *Code of Federal Regulations* (29 CFR) Part 1910.120(e), if necessary. These requirements include (1) 40 hours of formal off-site instruction, (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor, and (3) 8 hours of annual refresher training. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent. Confined space entry is not anticipated; therefore, that specialized training is not required.

Copies of all project personnel health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are maintained in project files.

Before work begins at this project site, all on-site personnel are required to undergo site-specific training that may cover the following areas:

- Names of personnel and alternates responsible for health and safety at the project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the generic HASP (Appendix D)

1.5.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on this project site. Training will meet OSHA requirements defined in 29 CFR 1910.120(e), if needed. Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to the project health and safety coordinator.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the "Safety Meeting Sign-Off Sheet" before they conduct on-site work. This briefing covers the topics described in Section 1.5.1 and is conducted by the project on-site health and safety officer or other qualified person.

Subcontractors are responsible for conducting their own safety briefings. The project health and safety coordinator may audit these briefings.

1.5.3 Specialized Training and Certification Requirements

In addition to the required OSHA health and safety training described in the section above, TIMET requires that every person that enters the plant undergo an in-house visitor orientation that presents the basic operation of the plant, hazards that may be encountered, audio and visual safety alarms for plant emergencies, and the procedure to follow in response to emergencies. Each visitor to the TIMET site must have the signed card signifying completion of the visitor orientation.

1.6 DOCUMENTS AND RECORDS

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.6.1 Field Documentation

Records should be kept in logbooks; a bound field notebook with consecutively numbered, water-repellent pages should be maintained. The logbook should be clearly identified with the name of the activity, the person assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries. All field notes will be recorded in the field log book in accordance with SOP No. 3 in Appendix E.

The field logbook should serve as the primary record of field activities. Logbooks should allow a reviewer to reconstruct applicable events by introduction of entries in chronological order. The logbook should be maintained in a clean area and used only when outer gloves have been removed. In addition to the field logbook, the field team will also use the forms attached to the appropriate SOP to record field activities.

1.6.2 Summary Data Package

At a minimum, the subcontracted laboratory will prepare summary data packages. This data will be of sufficient quality to complete a risk assessment in accordance with EPA guidance. The summary data package will consist of a case narrative, copies of all associated chain-of-custody

forms, sample results, and QC summaries. The case narrative will include the following information:

- Subcontractor name, project name, project order number, sample delivery group (SDG) number, and a table that references client and laboratory sample ID numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional requirements for the summary data package are outlined in Table 3. The subcontracting laboratory will provide the project QA manager with two copies (hardcopy and portable document format) of the summary data package within 28 calendar days after it receives the last sample in the SDG. At a minimum, summary data packages will be required for every deliverable of analytical data. The summary data package requirements listed above are consistent with the documentation necessary to conduct Tier 1A, 1B, and 2 validation according to the requirements set forth in NDEP's Data Verification and Validation Requirements letter, dated May 3, 2006 (NDEP 2006).

1.6.3 Full Data Package

In addition to the summary data packages described above, full data packages may be required for at least 10 percent of the data. The QA manager may decide to require a full data package at any time during the remaining data collection event to ensure that all QA procedures described in this SAP are being adequately followed. When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) Statements of Work (SOW) (EPA 1999a, 2000b). Full data packages will contain all of the information from the summary data package and all associated raw data. Full data package requirements are outlined in Table 4. Full data packages are due to the project QA manager within 35 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package. The full data package requirements listed above are consistent with the documentation necessary to conduct full validation to raw data according to the requirements set forth in NDEP's Data Verification and Validation Requirements letter, dated May 3, 2006 (NDEP 2006).

TABLE 3: REQUIREMENTS FOR SUMMARY DATA PACKAGES

Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Requirements for Summary Data Packages – Organic Analysis	Requirements for Summary Data Packages – Inorganic Analysis
Section I Case Narrative	**Section I Case Narrative**
1. Case narrative	1. Case narrative
2. Copies of nonconformance and corrective action forms	2. Copies of nonconformance and corrective action forms
3. Chain-of-custody forms	3. Chain-of-custody forms
4. Copies of sample receipt notices	4. Copies of sample receipt notices
5. Internal tracking documents, as applicable	5. Internal tracking documents, as applicable
Section II Sample Results - Form I for the following:	**Section II Sample Results - Form I for the following:**
1. Environmental samples, including dilutions and reanalysis	1. Environmental samples, including dilutions and reanalysis
2. Tentatively identified compounds (TIC) (volatile organic compounds and semivolatile organic compounds only)	
Section III Quality Assurance/Quality Control (QA/QC) Summaries - Forms II through XI for the following:	**Section III** QA/QC Summaries - Forms II through XII for the following:
1. System monitoring compound and surrogate recoveries (Form II)	1. Initial and continuing calibration verifications (Form II)
2. Matrix spike (MS) and matrix spike duplicate (MSD) recoveries and relative percent differences (RPD) (Forms I and III)	2. Project-required reporting limit standard (Form II)
3. Blank spike or laboratory control sample (LCS) recoveries (Forms I and III-Z)	3. Detection limit standard (Form II-Z)
4. Method blanks (Forms I and IV)	4. Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5. Performance check (Form V)	5. Inductively coupled plasma (ICP) interference-check samples (Form IV)
6. Initial calibrations with retention time information (Form VI)	6. MS and post-digestion spikes (Forms V and V-Z)
7. Continuing calibrations with retention time information (Form VII)	7. Sample duplicates (Form VI)
8. Quantitation limit standard (Form VII-Z)	8. LCSs (Form VII)
9. Internal standard areas and retention times (Form VIII)	9. Method of standard additions (Form VIII)
10. Analytical sequence (Forms VIII-D and VIII-Z)	10. ICP serial dilution (Form IX)
11. Gel permeation chromatography (GPC) calibration (Form IX)	11. IDL (Form X)
12. Single component analyte identification (Form X)	12. ICP interelement correction factors (Form XI)
13. Multicomponent analyte identification (Form X-Z)	13. ICP linear working range (Form XII)
14. Matrix-specific method detection limit (Form XI-Z)	

TABLE 4: REQUIREMENTS FOR FULL DATA PACKAGES

Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Requirements for Full Data Packages -- Organic Analysis	Requirements for Full Data Packages -- Inorganic Analysis
Sections I, II, and III Summary Package	**Sections I, II, III** Summary Package
Section IV Sample Raw Data - indicated form, plus all raw data	**Section IV** Instrument Raw Data - Sequential measurement readout records for any instrumentation used, which will contain the following applicable information:
1. Analytical results, including dilutions and re-analysis (Forms I and X)	1. Environmental samples, including dilutions and re-analysis
2. TICs (Form I — VOA and SVOA only)	2. Initial calibration
	3. Initial and continuing calibration verifications
Section V QC Raw Data - indicated form, plus all raw data	4. Detection limit standards
1. Method blanks (Form I)	5. Method blanks, continuing calibration blanks, and preparation blanks
2. MS and MSD samples (Form I)	6. ICP interference check samples (only for ICP instruments)
3. Blank spikes or LCSs (Form I)	7. MS, MSD, and post-digestion spikes
	8. Sample duplicates
Section VI **Standard Raw Data - indicated form, plus all raw data**	9. LCSs
1. Performance check (Form V)	10. Method of standard additions
2. Initial calibrations, with retention-time information (Form VI)	11. ICP serial dilution (only for ICP instruments)
3. Continuing calibrations, with retention-time information (Form VII)	12. Tracer yields for radionuclide analyses
4. Quantitation-limit standard (Form VII-Z)	
5. Gel permeation chromatography calibration (Form IX)	
	Section V Other Raw Data
Section VII Other Raw Data	1. Percent moisture for soil samples
1. Percent moisture for soil samples	2. Sample digestion, distillation, and preparation logs, as necessary
2. Sample extraction and cleanup logs	3. Instrument analysis log for each instrument used
3. Instrument analysis log for each instrument used (Form VIII-Z)	4. Standard preparation logs, including initial and final concentrations for each standard used
4. Standard preparation logs, including initial and final concentrations for each standard used	5. Formula and a sample calculation for the initial calibration
5. Formula and a sample calculation for the initial calibration	6. Formula and a sample calculation for soil sample results
6. Formula and a sample calculation for soil sample results	

1.6.4 Data Package Format

The subcontracted laboratory will provide EDDs for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDDs. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDDs will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with the requirement provided in the laboratory statement of work. Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the matrix spike (MS), matrix spike duplicate (MSD), blank spikes, or laboratory control sample (LCS)
- Matrix duplicate (MD) results reported for the SDG
- All reanalysis, reextractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples

A supplemental EDD is being developed by TIMET in conjunction with Paragon that will include calibration data and other method-specific QC results not captured in the current customized format. This supplemental EDD format is under design and will be presented as an attachment to this generic SAP when finalized.

Electronic and hard-copy data must be retained for a minimum of 3 and 10 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

1.6.5 Reports Generated

A report will be prepared at the conclusion of the field work. The report will include a summary of the results of previous related investigations, field and sampling procedures for the solid and water data collection events, solid and water target analyte concentrations and associated QC data, conclusions, and recommendations for the site. As an appendix to the investigation report, a data validation summary report (DVSR) will be completed according to applicable and current EPA and NDEP guidance.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following:

- Sampling Process Design (Section 2.1)
- Sampling Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)
- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Nondirect Measurements (Section 2.9)
- Data Management (Section 2.10)

2.1 SAMPLING PROCESS DESIGN

{Not addressed in this document. To be developed in the project-specific SAP.}

2.2 SAMPLING METHODS

{Sections 2.2.1 through 2.2.4 are not addressed in this document. To be developed in the project-specific SAP.}

2.2.5 Field-based Analysis

Several options are available to conduct field-based testing on solid and aqueous matrices. The usefulness of field-based tests will be determined during the DQO process. Field-based analysis can be very useful for making near real-time decisions in the field. Details regarding the type, number, and QC requirements for each type of test will be outlined in the project-specific SAP. Field-based tests may include the following:

- In-situ groundwater quality monitoring is used to determine the stability of groundwater in monitoring wells prior to collection of groundwater samples. In addition, water quality data are useful to describe the condition of the groundwater.

- Immunoassay test kits are used to measure organic compounds (such as polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, etc.) in solid and aqueous matrices.

- Photoionization detectors (PID) and flame-ionization detectors (FID) are hand-held instruments designed to measure volatile organic vapors emanating from either solid or aqueous matrices.

Field-based analyses are designed to be used in conjunction with fixed-laboratory analyses to make timely and cost-effective decisions. For the purposes of this generic SAP, the field-based analyses are not intended to be stand-alone tests, but correlated to fixed-laboratory tests. Other test types and other uses of the field-based analytical data will be discussed in any project-specific SAPs.

2.2.6 Decontamination

Any reusable sample collection equipment will be thoroughly decontaminated before work begins and between installation of each soil boring as well as between collection of samples from each location. Decontamination of the equipment will follow general practices listed in SOP No. 7 (Appendix E). A portable steam cleaner and an on-site source of potable water will be used for decontamination, and all water derived from decontamination will be collected and temporarily stored on site for characterization. An on-site source of potable water for the steam cleaner will be available. No other equipment will require decontamination.

2.2.7 Management of Investigation-Derived Waste

IDW may include soil cuttings from drilling activities, purge water and pump-test water from groundwater monitoring wells, and wastewater from decontamination procedures and collection of equipment rinsate samples. Composite IDW soil sample(s) will be obtained from cuttings accumulated in drums depending upon the size and complexity of the investigation. IDW soil sample(s) may be analyzed for the toxicity characteristic leaching procedure (TCLP) for volatile organic compounds (VOC), TCLP metals, and radionuclides, as necessary, to adequately profile the material to ensure compliance with the disposal facilities' permit requirements.

Purge and pump-test water will be consolidated into an appropriate container(s) during each sampling event (typically a 55-gallon drum). A representative sample will be collected from the container and submitted for waste characterization. Upon receipt of the analytical data, the water will be profiled and transported to a permitted off-site disposal facility.

Miscellaneous waste, such as personal protective equipment, disposable sampling equipment, polyethylene sheeting, and general trash, will be disposed of as municipal solid waste.

2.2.8 Sample Containers and Holding Times

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for samples prior to extraction and analysis are presented in Table 5.

2.3 SAMPLE HANDLING AND CUSTODY

This section describes sample handling procedures, including sample identification and labeling, documentation, chain-of-custody, and shipping.

2.3.1 Sample Identification

A unique sample identification number will be assigned to each sample collected during this project. The sample identification numbering system is designed to be compatible with a computerized data management system that includes previous results for samples collected at this site. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis. The numbering system indicates the site abbreviation, sampling type and the location number. For the soil boring samples, a number will be added to specify the position of the sample in the vertical sequence. The numbering scheme is illustrated below. Other nomenclature may be adopted on a project-specific basis for other media.

Site:	TM – TIMET
Sampling Activity:	SB – soil sample collected from a boring SE – sediment MW – groundwater sample collected from a monitoring well SW – surface water
Specific Sample Location:	Specific sample locations are numbered consecutively for each specific sampling activity
Sample Depth:	For soil samples only, the sample depth will be indicated by the depth of the bottom of the interval (for example, 9 to 10 feet will be designed “10”).

Field quality control samples for this investigation are limited to field duplicate samples for water samples, trip blanks for VOC samples, equipment rinsates for each sampling equipment type, and source water blanks. One source water blank will be necessary for each source of water used at the site. One equipment rinsate per day will be required from the drilling equipment. Equipment rinsate blanks will be identified as “ER” followed by a consecutive number (starting with 101). Additional volume may be required for MS/MSD analysis by the laboratory. No special requirements for nomenclature apply to these samples.

TABLE 5: SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS
Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Parameter [a]	Matrix	Sample Volume	Sample Container	Preservative [b]	Holding Time (extraction/ analysis)
Anions	Aqueous	500 mL	Polyethylene	Cool, 4 ± 2 °C	28 days [c]
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days [c]
Dioxins/Furans	Aqueous	1 Liter	Amber bottles w/Teflon top	Cool, 4 ± 2 °C	7 days/30 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	30 days/45 days
Ammonia and TKN	Aqueous	500 mL	Polyethylene	4 ± 2 °C; H_2SO_4	28 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
Cyanide (total)	Aqueous	500 mL	Polyethylene	4 ± 2 °C; NaOH	14 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
Iodine	Aqueous	100 mL	Polyethylene	Cool, 4 ± 2 °C	24 hours
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
pH	Aqueous	100 mL	Polyethylene	Cool, 4 ± 2 °C	24 hours
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
Total inorganic carbon	Aqueous	100 mL	Polyethylene	Cool, 4 ± 2 °C	28 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
TOC	Aqueous	100 mL	Polyethylene	4 ± 2 °C; HCl	28 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	28 days
Metals	Aqueous	1 Liter	Polyethylene	pH < 2 with HNO_3	6 months [d]
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	6 months [d]
Organochlorine Pesticides	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Chlorinated Herbicides	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
SVOCs (including PAH)	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
PCBs	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
TPH (Purgeables)	Aqueous	2 40-mL	Glass vials w/Teflon septum	Cool, 4 ± 2 °C	14 days
	Solid	2 oz	Glass jar	Cool, 4 ± 2 °C	7 days/40 days
TPH (Extractables)	Aqueous	1 Liter	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Radionuclides (except	Aqueous	4 liters	Polyethylene container	pH < 2 with HNO_3	6 months

TABLE 5: SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS (CONTINUED)
Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Parameter [a]	Matrix	Sample Volume	Sample Container	Preservative [b]	Holding Time (extraction/ analysis)
Radon)	Solid	8 oz	Glass jar	None	6 months
Radon-222	Aqueous	2 40-ml vials	Glass vial with Teflon top	None	4 days [e]
VOCs	Aqueous	3 40-ml vial	Glass sample vials w/Teflon	4 ± 2 °C; HCl	14 days
	Solid	3 plugs	Encore or similar device	Cool, 4 ± 2 °C	7 days
Water Quality Parameters	Aqueous	500 mL	Polyethylene	Cool, 4 ± 2 °C	14 days [f]
Dissolved Gases	Aqueous	3 40-ml vial	Glass sample vials w/Teflon	4 ± 2 °C; HCl	4 days [e]
Chlorinated Compounds	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
OP Pesticides	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Organic Acids	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Non-Halo Organics	Aqueous	3 40-ml vial	Glass sample vials w/Teflon	4 ± 2 °C; HCl	14 days
	Solid	3 plugs	Encore or similar device	Cool, 4 ± 2 °C	7 days
Aldehydes	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Flashpoint	Aqueous	40-mL vial	Glass sample vial	Cool, 4 ± 2 °C	48 hours
	Solid	2 plugs	Encore or similar device	Cool, 4 ± 2 °C	48 hours
White Phosphorus	Aqueous	2 Liters	Amber glass jar	Cool, 4 ± 2 °C	7 days/40 days
	Solid	8 oz	Glass jar	Cool, 4 ± 2 °C	14 days/40 days
Methyl Mercury	Aqueous	1 Liter	Amber glass jar	4 ± 2 °C; H_2SO_4	6 months [e]
	Solid	8 oz	Glass Jar	Cool, 4 ± 2 °C	
Asbestos	Aqueous	1 Liter	Polyethylene	None	Indefinite
	Solid	8 oz	Plastic baggie	None	Indefinite

TABLE 5: SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS (CONTINUED)

Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Notes: More than one analysis can be performed from the same sample container. The sample quantities listed in the table are the quantities necessary if only the specific analysis is requested. The laboratory will indicate which of the analyses can be performed from the same container, so that a smaller quantity of sample can be collected at each location.

a Analyte lists and method references are provided in Tables B-1 and B-2 in Appendix B of this document.

b When chemical preservation with acids, the pH should be less than 2. When chemical preservation with NaOH, the pH should be greater than 12.

c Anion aqueous holding time is 28 days; except for nitrate, nitrite, orthophosphate, sulfite that must be analyzed within 48 hours of sampling. Anions analyzed on solid matrices have a 28-day holding time to extraction; 48 hours after extraction to analysis.

d Aqueous and solid holding time for metals is 6 months; except for mercury that must be analyzed within 28 days of sampling for both aqueous and solid matrices.

e Radon, water quality parameters, dissolved gases, and methyl mercury will only be analyzed in aqueous matrices.

f The holding time for most of the water quality parameters is 14 days; except for total dissolved and total suspended solids (7 days).

2.3.2 Sample Labels

A sample label will be affixed to all sample containers. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After each sample is labeled, it will then be refrigerated or placed in a cooler that contains sufficient ice to maintain the sample temperature at 4 ± 2 °C for the analyses requiring temperature preservation according to Tables 5A and B.

2.3.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Field personnel will adhere to SOP No. 3 and follow the general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink
- All entries will be legible
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout
- Any project documents will be maintained by the Field Team Leader or TIMET and referenced in the site logbook
- Unused portions of pages will be crossed out, and each page will be signed and dated

Section 1.6.1 includes additional information on how logbooks will be used to document field activities. The FTL is responsible for ensuring that sampling activities are properly documented.

2.3.4 Chain of Custody

Standard sample custody procedures will be used to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container

used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins when samples are received and continues until samples are discarded. Laboratories analyzing samples for this project must follow custody procedures at least as stringent as are required by the EPA CLP SOWs (EPA 2007a, 2007b). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons delivering the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. This information should be entered into a computerized LIMS. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples requiring special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

2.3.5 Sample Shipment

The following procedures (also outlined in SOP No. 4 in Appendix E) will be implemented when samples collected during this project are shipped:

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature of within the range of 2 to 6 °C.

- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.

- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.

- Signed and dated custody seals will be placed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental breakage.

- The chain-of-custody record will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the chain-of-custody record to document transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

2.4 ANALYTICAL METHODS

Tables B1 and B2 in Appendix B present the analytical methods, target analytes, and PRRLs that will be used for samples collected at TIMET, and Appendix A presents the method precision and accuracy goals for sample analysis. The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. If problems occur in achieving the PRRLs, the laboratories will contact the project QA manager immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the method detection limit will be reported with appropriate qualifiers to indicate the greater uncertainty associated with these values.

The analytical methods required for this investigation are all EPA SW-846 methods (EPA 2004e) or EPA-approved methods from other references. Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following sections.

2.4.1 Selection of Analytical Laboratories

Two types of laboratories may be selected for projects: (1) chemical analytical laboratories, and (2) geotechnical testing laboratories. Laboratories will be selected based on their certification from the NDEP and from successful completion of an on-site laboratory audit by the project QA manager. TIMET anticipates that chemical analytical services will be provided by Paragon Analytics, Inc. (Paragon), of Fort Collins, Colorado and Columbia Analytical Services, Inc. (CAS) of Kelso, Washington. Appendix C includes laboratory-specific information regarding their current NDEP approval certificate and status, MDLs, Quality Assurance Manual, and radionuclide SOPs (for Paragon only). Geotechnical testing services will be provided by Daniel B. Stephens & Associates, Inc. Hydrolic Testing and Research Laboratory of Albuquerque, New Mexico.

The laboratory SOW is a detailed document that establishes standard requirements for the analytical methods for this project. For each method, the laboratory SOW specifies standard method-specific target analyte lists and PRRLs; QC samples and associated control limits; calibration requirements; and miscellaneous method performance requirements. The laboratory SOW also specifies standard data package requirements, electronic data deliverable formats, data

qualifiers, and delivery schedules. In addition, the laboratory SOW outlines support services (such as providing sample containers, trip blanks, temperature blanks, sample coolers, and custody forms and seals) that are expected of laboratories. The laboratory SOW incorporates EPA and NDEP QA guidelines, as appropriate. All qualified laboratories will commit to meeting the requirements in the laboratory SOW during the contracting process before they receive samples.

2.4.2 Project Analytical Requirements

One or more qualified and NDEP-approved subcontractor laboratories may analyze samples of soil, sediment, solid waste streams, groundwater, surface water, or waste water. The laboratories will be selected before the field program begins based on their ability to meet the project analytical and QC requirements, as well as their ability to meet the project schedule. All methods are listed in Table 5.

This SAP documents project-specific QC requirements for the selected analytical methods. Sample volume, preservation, and holding time requirements are specified in Table 5. Requirements for laboratory QC samples are described in Table 2 and in Section 2.5. Appendix A includes project-specific precision and accuracy goals for the methods. Finally, PRRLs for each method are documented in Appendix B.

2.5 QUALITY CONTROL

The quality of field data will be assessed through regular collection and analysis of field QC samples. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures are conducted properly and that the quality of the data is known.

2.5.1 Field Quality Control Samples

QC samples are collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. Frequencies for field QC samples are based on recommendations from the EPA guidance documents "Test Methods for Evaluating Solid Waste" (EPA 2004e) and "Contract Laboratory Guidance for Field Samplers" (EPA 2004a). Table 6 summarizes the types and frequency of collection of field QC samples. While MS, MSD, and MD samples are actually laboratory QC samples, their selection will be made in the field and extra volume must be collected for groundwater samples. As such, they are also included in Table 6, but are discussed with laboratory QC samples (Section 2.5.2).

TABLE 6: FIELD QC SAMPLES

Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Sample Type	Frequency of Analysis	Matrix
MS, MSD, and MD [a]	1 per 20 samples of similar matrix or analytical batch	Solid and water
Field duplicate	1 per 10 water	Water
Trip blank	1 per shipping container with VOC water samples	Water
Equipment rinsate	1 per day per type of reusable sampling tool used	Solid and water
Source water blank	1 per each water source used for decontamination	Water

Notes:

a Even though MS, MSD, and MD are laboratory QC samples, their selection will be determined in the field and recorded on the chain of custody. For groundwater, a triple volume of sample is required for these analyses. Not all test methods required the use of MS, MSD, and/or MD. See tables in Appendix A for required laboratory QC samples.

MD Matrix duplicate
MS Matrix spike
MSD Matrix spike duplicate
QC Quality control
VOC Volatile organic compounds

2.5.1.1 Field Duplicates

Field duplicate samples are collected at the same time and from the same source and then submitted as separate samples to the laboratory for analysis. Field duplicate samples will be collected for water samples at a frequency specified in Table 6.

While field duplicate soil samples may be collected as soil samples from adjacent locations, duplicate samples for soil are not set out in this document as a requirement for two reasons. First, because adjacent soil samples incorporate some spatial variability, these samples cannot be used directly to assess sampling precision. Furthermore, it is not practical to set QC limits for the relative percent difference of these samples, which precludes their use for QC purposes. Second, while the information on spatial variability that can be obtained from adjacent soil samples may be useful in assessing or implementing remedial options, no objectives relating to these data uses have been identified for this project. Rather, it has been determined that this type of information on spatial variability will be obtained during subsequent investigations at this site, if necessary. Note that soil field duplicates may be added as a requirement for a specific project as necessary based on the DQOs for that project.

2.5.1.2 Trip Blanks

Contamination can be introduced from external sources during shipment of field samples to the laboratory. Trip blanks will be made by the laboratory and will be shipped to the site with the field collection kits prior to sampling. During sampling, trip blanks will be stored in coolers containing water samples for VOC and gasoline analysis. During shipment, one trip blank will be included in each cooler containing water samples for VOC and gasoline analysis. Analytically certified, organic-free water or equivalent will be used for trip blanks.

If any contaminant is present in the trip blank samples above the SQL, the result for associated field samples that contain the same contaminant will be qualified as potentially not detected if the concentration of the field sample is less than five times (or 10 times for common laboratory contaminations such as acetone, methylene chloride, and phthalates) the concentration found in the blank.

2.5.1.3 Equipment Rinsate Samples

Equipment rinsate samples will be collected during solid and water sampling at a frequency of once per day of sampling per team per type of tool used. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free water or equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

2.5.1.4 Source Water Blank Samples

One source water blank will be collected for each sampling event and for each source of water (distilled, deionized, or from an industrial or residential water source). It is anticipated that only one source water blank will be needed, as the only equipment decontaminated will be steam cleaned.

2.5.2 Laboratory Quality Control Samples

The types of laboratory QC samples that will be used for this project are discussed in the following sections. Table 6 presents the required frequencies for laboratory QC samples, and Appendix A presents project-specific precision and accuracy goals for these samples.

2.5.2.1 Method Blanks

Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

2.5.2.2 Matrix Spike and Matrix Spike Duplicates

MS/MSD samples for water matrices require collection of an additional volume of material for laboratory spiking and analysis; for solid matrices, additional sample mass is generally not required. MS/MSD samples will be collected at a frequency of 5 percent (or one per 20) for each matrix. Percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The RPD between spiked samples will be calculated to evaluate precision. Project-specific precision and accuracy goals are presented in Appendix A.

2.5.2.3 Matrix Duplicates

MD samples are laboratory-generated sample aliquots prepared in duplicate for analyses where spiking of the analyte is impractical or not applicable. MDs will be prepared by the laboratory and analyzed for radionuclides and total dissolved solids in water and radionuclides in solid samples. Additional sample mass from the field is not required for solid samples; however, double sample volume is required for water. MD samples will be prepared at a frequency of 5 percent for both solid and water matrices. The RPD between MD results will be calculated to evaluate precision. Project-specific precision and accuracy goals are presented in Appendix A. Note that MDs are different from field duplicates. MDs are duplicate aliquots of sample prepared and analyzed by the laboratory; whereas field duplicates are separate samples collected at co-located sampling locations.

2.5.2.4 Laboratory Control Samples

LCSs (sometimes known as blank spikes) will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to gauge the usability of the data.

2.5.2.5 Surrogate Standards

Surrogate standards consist of known concentrations of nontarget organic analytes that are added to each field sample and QC sample before samples are prepared and analyzed. The surrogate standard measures the efficiency of the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed by GC for volatile and extractable organic constituents. Surrogate compounds are used in the analysis of VOCs and gasoline to monitor purge efficiency and analytical performance, whereas surrogates are used in the analysis of extractable organic compounds to monitor the extraction process and analytical performance.

2.5.2.6 Internal Standards

Internal standards are compounds that are added to every VOC, semivolatile organic compound (SVOC), and dioxin and furan standard, method blank, MS/MSD, and sample or sample extract at a known concentration prior to analysis. Internal standards are used as the basis for quantification of gas chromatography/mass spectrometry (GC/MS) target compounds and ensure that the GC/MS sensitivity and response are stable during the analytical run. An internal standard is used to evaluate the efficiency of the sample introduction process and monitors the efficiency of the analytical procedure for each sample matrix encountered. Internal standards may also be used in the analysis of organic compounds by GC to monitor retention-time shifts. Validation of internal standards data will be based on EPA protocols presented in guidelines for evaluating organic analyses (EPA 1999b).

2.5.2.7 Retention Time Windows

Retention time windows will be established as described in SW-846 Method 8000A (EPA 2004e) for applicable analyses of organic compounds. Retention time windows are used for qualitative identification of analytes and are calculated based on multiple, replicated analyses of a respective standard.

Retention times will be checked on a daily basis. Acceptance criteria for retention time windows are reestablished in the referenced method. If the retention time falls outside the respective window, corrective action such as recalibration and reanalysis will be taken to correct the

problem. The instrument must be re-calibrated after any retention time window failure and the affected samples must be reanalyzed.

2.5.2.8 Special Quantitation Methods for Short-Lived Radionuclides

For several "short-lived" radionuclides, the basis for quantitation will be "back-quantitation" from parent radionuclides. This specific group of exceptional radionuclides represents those compounds with relatively short half-lives ranging from seconds to days. It is recognized that for these radionuclides of interest any measured concentration in the sample may not reflect the predicted presence.

2.5.3 Additional Laboratory Quality Control Procedures

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed in the following sections.

2.5.3.1 Method Detection Limit Studies

The MDL is the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL takes into account sample matrix and preparation but does not regard sample-specific matrix effects. The subcontractor laboratory will demonstrate the MDLs for all analyses except physical properties test methods. Paragon MDLs are provided in Appendix C of this document.

MDL studies will be conducted annually for all matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits. The replicates will be extracted and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

2.5.3.2 Sample Quantitation Limits

SQLs are the laboratory MDL adjusted for the characteristics of individual samples. PRRLs are the project required reporting limits. The PRRLs presented in Appendix B are chemical-specific levels that a laboratory should be able to routinely detect and quantitate in a given sample matrix. The PRRL is usually defined in the analytical method or in laboratory method documentation. The SQL takes into account changes in the preparation and analytical methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

2.5.3.3 Control Charts

Control charts document data quality in graphic form for specific method parameters such as surrogate standards and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Although they are not required, control charts are recommended for organic and inorganic analyses. At a minimum, method-blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. It is further recommended that control charts be updated monthly.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) SOPs that describe equipment operation associated with particular applications of the instrument. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The FTL will be notified of equipment malfunctions so that service can be completed quickly or substitute equipment can be obtained. When the condition of equipment is suspect, unscheduled testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected for this project. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

The following sections discuss calibration procedures that will be followed to ensure the accuracy of measurements made using field and laboratory equipment.

2.7.1 Calibration of Field Equipment

Field measurements of well development conditions (pH, conductivity, turbidity, and temperature) will be monitored prior to water sample collection. Field equipment will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals, and general guidelines are included in SOP No. 6. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference.

2.7.2 Calibration of Laboratory Equipment

Procedures and frequencies for calibration of laboratory equipment will follow the requirements in the methods referenced in Section 2.4.2 of this SAP. Qualified analysts will calibrate laboratory equipment and document the procedures and results in a logbook.

The laboratory will obtain calibration standards from commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate standards and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

With the assistance of FTLs, project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete this project and are responsible for determining acceptance criteria for these items.

Supplies and consumables will be received at the project site. When supplies are received, the project manager or FTL will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order and the item will then be returned to the vendor for replacement or repair. Any deficiencies or problems will also be noted in the field logbook, and deficient items will be returned for immediate replacement.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers" (EPA 1992).

2.9 NONDIRECT MEASUREMENTS

Non-direct data include various types of information obtained from non-measurement sources such as computer databases, spreadsheets, and programs, as well as literature searches. For this project, it is anticipated that non-direct measurement data from existing databases from other companies in the BMI Complex will be used to supplement the investigation. Before using analytical data from these sources, the data will be validated either by the originating company, or by the TIMET project chemist.

Other potential types of non-direct data inputs include calculations of some radionuclide concentrations. These data will only be obtained from validated direct measurements prior to use.

2.10 DATA MANAGEMENT

Field and analytical data collected from this project are critical to meeting the project objectives listed in Section 1.3. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into an Access® database for TIMET. The database contains data for (1) summarizing observations of chemical and geologic conditions, (2) preparing reports and graphics, and (3) integrating with geographic information systems (GIS). The following sections describe the project's data tracking procedures, data pathways, and overall data management strategy for this project.

2.10.1 Data Tracking Procedures

All analytical data that are generated in support of this project are tracked through an Access® database. Information related to the receipt and shipment of samples (from chain-of-custody records), field data (from extended chains of custody), SDGs (as data packages from the laboratory) and status of data review and validation are recorded to provide the project manger and QA chemist with status reports of progress as requested.

2.10.2 Data Pathways

Data are generated from three primary pathways for this project—data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the database. Data pathways must be established and well documented to evaluate whether the data have been accurately loaded into the database in a timely manner.

Data generated during field activities are recorded using field forms appended to the appropriate field SOP. The FTL reviews these forms for completeness and accuracy. Data from the field forms, including the chain-of-custody form, are entered into the Access® database for TIMET. This step in the process establishes the records of field sampling location (including survey data, if applicable) and sample identification number.

Data generated during laboratory analysis are recorded in hardcopy and in EDDs after the samples have been analyzed. The laboratory will send the hardcopy and EDD records to the project QA manager. The QA manager oversees a qualified chemist who reviews the data deliverable for completeness, accuracy, and electronic format. Any and all issues regarding the data completeness, accuracy or format are addressed by the laboratory before data are entered into the TIMET database. After the format has been approved, the electronic data are downloaded into the TIMET database. Lithologic data from the field is entered in LogPlot® and/or Rockworks®. Survey data is entered into a GIS database and the basemap is updated.

Data validation is conducted by a qualified chemist, whose work is reviewed by the project QA manager. After validation, the electronic data are reviewed against the hardcopy package and appropriate data validation qualifiers and comment codes are added to the database. At this point, all data records (field and validated analytical data) have been verified for accuracy, qualified based on validation findings, and can be reported as data tables, summaries, comparisons, or maps.

2.10.3 Data Management Strategy

The project data management strategies require that the database for TIMET be updated as new and validated data are imported. The data consist of chemical and field data from all contractors working on this project, entered into an Access® database. The database can be used to generate reports using available computer-aided drafting and design and contouring software. All electronic data from this database will be stored and maintained.

To satisfy long-term data management goals, the data will be loaded into the TIMET database at Tetra Tech for storage, further manipulation, and retrieval after laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and graphic representations of the data. Additional data acquired from field activities are recorded on field forms appended to the appropriate field SOP that are reviewed for completeness and accuracy by the analytical coordinator or FTL. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project numbers. Laboratory data packages and reports will be archived at Tetra Tech offices. These records will be maintained for a minimum of 10 years following termination of the Consent Agreement. Laboratories that generated the data will archive hard-copy data for a minimum of 10 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the laboratory assessment that may be conducted during TIMET data collection projects, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to the client.

3.1 ASSESSMENT AND RESPONSE ACTIONS

The Project Team will oversee collection of environmental data using the laboratory assessment and audit activities described below. Problems encountered during a laboratory assessment will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

3.1.1 Laboratory Assessments

A pre-award assessment of each laboratory will be conducted by the project QA manager or designee before they are placed on the approved list for performing work for TIMET. These assessments include (1) reviews of laboratory certifications, (2) initial and annual demonstrations of the laboratory's ability to satisfactorily analyze single-blind performance evaluation samples, and (3) laboratory audits. Laboratory audits may consist of an on-site review of laboratory facilities, personnel, documentation, and procedures, or an off-site evaluation of the ability of the laboratory's data management system to meet contract requirements.

An audit of the selected laboratory for TIMET projects may be conducted after the laboratory receives and begins processing samples. The purpose of this audit will be to review implementation of the methods specified in this SAP and to ensure that appropriate QC procedures are being implemented in association with these methods.

3.1.2 Assessment Responsibilities

The project QA manager will select the appropriate personnel to conduct each assessment and will assign them responsibilities and deadlines for completing the assessment. These personnel may include the program manager or any senior technical staff member with relevant expertise and experience in assessment.

When an assessment is planned, the project QA manager may conduct the audit or select a lead assessor who is responsible for the following:

- Coordinating and scheduling the assessment with the project team, subcontractor, or other organization being evaluated
- Participating in the assessment
- Coordinating preparation and issuance of assessment reports and corrective action request forms
- Evaluating responses and resulting corrective actions.

After an assessment is completed, the lead assessor will submit an audit report to the project QA manger, project manager, and technical project manager. Other personnel may be included in the distribution as appropriate. Assessment findings will also be included in the quality control summary report for the project (Section 3.2.3).

3.1.3 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the project QA manager within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the project QA manager. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment and review of all activities, and (2) open communication, interaction, and feedback among all project participants. The reports described below will be used to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

Daily progress reports will be prepared by the FTL to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used by all field personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the FTL and submitted to the project manager and technical project manager. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Status Report

The project manager will prepare a status report to be submitted to the TIMET manager. In addition, quarterly schedules and project updates are prepared and delivered to NDEP. Status reports address project-specific quality issues and facilitate their timely communication. The status report will include the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

3.2.3 Quality Control Summary Report

A quality control summary report will be prepared and submitted by the QA manager or her designee. The quality control summary will include a summary and evaluation of QA/QC activities, including any field or laboratory assessments, completed during the investigation. The primary focus of the quality control summary report is determining whether project DQOs were met and whether data are of adequate quality to support required decisions.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs and MQOs for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining defensible data of acceptable quality. Verification and validation methods for field and laboratory activities are presented below. Validation and reporting will be performed in accordance with the applicable EPA and NDEP guidance.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformance to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An experienced chemist will validate all laboratory data in accordance with current EPA national functional guidelines and NDEP guidelines (EPA 1999b, 2000c, 2004b; NDEP 2006, 2007). For most projects, 90 percent of the data for project analytes will undergo partial validation and 10 percent of the data for project analytes will undergo full validation. Requirements for partial and full validation are listed below.

4.1.3.1 Partial Data Validation

Generally, partial validation will be completed on 90 percent of the summary data packages for analysis of contaminants of concern. The data reviewer is required to notify the project chemist and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data. Partial validation is consistent with the definition of Tier 1 and 2 review levels defined in the EPA Region 9 draft validation guidance (EPA 2001b) and will be conducted according to the current EPA and NDEP guidance.

4.1.3.2 Full Data Validation

Generally, full validation will be completed on 10 percent of the full data packages for analysis of contaminants of concern. If project-specific DQOs require a different frequency of full data validation, then it will be defined in any project-specific SAP addendum. The data reviewer is required to notify the project chemist and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries. The requirements for full validation will be conducted according to the current EPA and NDEP guidance.

4.1.3.3 Data Validation Criteria

Table 7 lists the QC criteria that will be reviewed for both partial and full data validation. The data validation criteria selected from Table 7 will be consistent with the project-specific analytical methods referenced in Section 2.4 of the SAP.

4.1.4 Reconciliation with DQOs

During data review and validation, all data will be reconciled with the objectives of the project. As described in the above sections, all validation will be documented in an appropriate manner and data qualified to indicate when criteria are exceeded. Data not useful for inclusion in site evaluations will be clearly flagged as rejected. Other bias will be noted in the respective data validation memoranda to alert the data user to potential limitations.

Data will also be reconciled with the respective project DQOs, as described in Section 1.3, as part of the evaluation and reporting of findings of the various investigations.

TABLE 7: DATA VALIDATION CRITERIA
Generic Site-wide Sampling and Analysis Plan, Titanium Metals Corporation Facility

Analytical Parameter Group	Partial Data Validation Criteria	Full Data Validation Criteria
Organic Analyses	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Compound identification Detection limits Compound quantitation Sample results verification Other laboratory QC specified by the method Overall assessment of data for an SDG
Inorganic Analyses	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample Field duplicate sample analysis Other laboratory QC specified by the method Detection limits Analyte identification Analyte quantitation Sample results verification Overall assessment of data for an SDG

Notes:

QC Quality control
SDG Sample delivery group

4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met.

To the extent possible, data will be evaluated according to EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (EPA 2000c). The DQA process includes five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative, data quality and data usability will be systematically assessed. This assessment will include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met
- A review of project-specific DQOs to determine whether they have been achieved by the data collected
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

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